What Medicine Knows Today

Lockjaw: An Unavoidable Error.

This and the other articles to appear in this series have been prepared by specialists and medical men of wide reputation. Each contributor stands high in the field. Professional ethics prohibit them from attaching their names, but every statement is made with the highest authority.

Tetanus, or lockjaw, is one of the maladies that modern medicine has pretty well conquered. It is possible to prevent it, and if it is taken in time, it is possible to cure it. Therefore, there is no need whatever for any civilized white man to die of it. And yet it still takes a toll in the United States and each year its victims number about 1,500.

Tetanus is an acute infectious disease and is caused by a minute organism called the bacillus tetani. This bacillus was discovered by an observer named Nicolaier in 1885. It is long and slender and has a number of long flagella or feelers, which enables it to move about, though only very slowly.

No other virulent organism is more widely distributed in nature. It is found in the litter of every barnyard and in the dust of every city street. The prongs of every pitchfork in the land harbor it, and it is to be met in the earth of every field and flower garden. It has been found in dirty clothes, on shoe soles, in gutters, on the surface of fruit, on pocket knives and even in sea water.

In view of this universal distribution of the organism, the layman may wonder how it is that every person in the world, at some time or other, is not laid low by lockaw. The answer lies in the fact that the bacillus tetani, though well nigh omnipresent, is far from vigorous. It dies, in fact, so easily that many observers doubt whether it often reproduces its kind outside the living body.

Sunlight and fresh air are its chief enemies. Let a mass of the bacilli be placed in a strong light and where a current of air may reach them, and they will be dead in a few hours. They are also exceedingly vulnerable to most of the common antiseptics; and so it happens that in the vast maority of cases they are killed before they can do any damage.

When the bacilli are introduced into a wound, the body makes a two-fold effort to combat them and prevent their entrance into the blood-stream. In the first place, a sort of wall begins to form around them and they are thus isolated and starved out, and in the second place, the leucocytes, or germ-eating white blood corpuscles, begin to attack them and swallow them.

If this process happens to take place in an open wound into which light and air may enter, the light and air greatly aid the leucocytes—by debilitating the baccilli. The result is that the latter are killed soon and their dead bodies are expelled.

But in case the bacilli happen to get into a deep or ragged wound, into which light and air cannot penetrate, and in which a lot of other germs are living and multiplying, they increase rapidly, and begin to send their toxins into the blood stream, and so reach all parts of the body. The leucocytes, busy with the other germs, cannot fight them effectively and the absence of light and air favors their growth.

This is what often happens on the Fourth of July, when some luckless small boy wounds himself with a toy pistol. The powder makes a ragged, contused wound, and drives into its depths the tetanus bacilli that happen to be living in the grime upon his hands.

Instead of sending for a doctor, and having the wound properly washed and dressed, the boy's mother binds it up herself—perhaps with a dirty rag—and tells him to stop crying. This means that the lockaw germs are left where the powder forced them—deep down in the lacerated tissue, among dead and dying skin cells, and cut off from all light and air.

Protected thus, and living under conditions ideally adapted to their welfare, the bacilli begin to multiply and to secrete their poisons. These poisons are two in number, one being called tetanospasmin, and the other tetanolysin. They are taken up by the blood and distributed to all parts of the body, but it is chiefly the nerves that they attack.

The exact nature of this attack is still in dispute, but it is thought that the poisons—or toxins, as they are called—form some sort of chemical combination with the nerve substance and so destroy it. Whatever the modus operandi, the result is that the nerves that control motion begin to show signs of disease. The patient grows ill; his muscles twitch queerly; he has spasms. By and by the muscles of his face "run amuck" and his lower jaw becomes immovable. In the end the muscles controlling his lungs stop work and he suffocates, or the muscles controlling his heart stop, and he dies of heart failure.

The first symptoms of lockjaw usually appear from three days to three weeks after infection, the time in about half of all cases being two weeks. The earlier they appear the more fatal the attack. In all cases, whether death or recovery follow, the symptoms of lockjaw are most terrible, and the sufferings of the patient are equalled only by the horrors and anguish of those who watch at his bedside.

Fortunately, it is always possible to prevent lockjaw provided only that it be taken in time. Two methods present themselves. The first consists in cleansing the wound thoroughly with antiseptics and dressing it in a proper manner. This can be done only by an experienced physician. The second method consists in injecting tetanus antitoxin into the patient's veins, to kill the toxins as fast as they are given off by the bacilli. If done when the wound occurs, the patient recovers. If delayed until lockjaw symptoms appear, antitoxin is of little help.

The preparation of antitoxin is based upon the well-known fact that whenever the poisons from the germs of any infectious disease appear in the blood of man or any other suitable mammal, that blood begins at once to manufacture a substance which has the property of neutralizing the toxins secreted by those germs. This is nature's effort to cure. It is successful very often without the slightest outside aid.

But different animals exhibit varying powers of resistance to given germs or their toxins. In man, for example, the tetanus germ does a great deal of damage, because, when it begins to throw off its toxins, the human blood has a hard time manufacturing antitoxins fast enough to keep pace with them. But in horses, the blood seems to be better fitted for the work. That is to say, it makes tetanus antitoxins very rapidly and so keeps ahead of the toxin-making germs.

The fact is used to advantage in the manufacture of tetanus antitoxin for medical use. A healthy horse is selected and a small amount of tetanus toxin (not the germs, but their filtered product) is injected into its veins. Its blood immediately makes enough antitoxin to combat and destroy this toxin. Then it gets a second and larger dose and the process is repeated. Subsequent doses are made larger and larger, and by and by the horse's veins are so full of tetanus antitoxin that it can overcome and survive almost any conceivable dose of toxin.

The blood of this horse is then drawn, its solid matter is removed, and the power of the remaining serum is determined. This serum is what is commonly called tetanus antitoxin. When it is injected into the veins of a human patient, it attacks and destroys all tetanus toxin that appears in its path, just as if it were still in the veins of the horse.

The effectiveness of antitoxin, in treating tetanus, depends altogether upon the celerity with which it is used. The tetanus toxins, as we have seen, attack the motor nerves very quickly, and after they once take lodgment it is very difficult to neutralize them.

Therefore, it is best when the presence of tetanus germs is suspected, to make an injection of antitoxin at once. This fills the blood of the patient with the antitoxin, and so when the toxins appear they are tackled and overcome before they have had a chance to reach the nerve ends.

When the injection has been postponed until the active symptoms of the malady have appeared—that is to say, until after the toxins have begun to attack the nerve ends—it is necessary to inject large and frequent doses of the antitoxin. In the last stages of the disease, indeed, physicians sometimes inject the antitoxin directly into the spinal and brain cavities. This, of course, involves a serious and delicate operation, but it is always worth while to take the risk, because without the injection the patient is certain to die, while with it his chances of recovering become very considerable.

It seems to be impossible to give the patient too much antitoxin, and so physicians employ large and frequent doses. In serious cases injections are made every two or three hours and double units are used. When the gravity of the case seems to warrant it, the spinal cord is exposed, the cerebrospinal fluid is drawn off, and its place is filled with antitoxin. It is only thus that the toxins in the large nerve centers may be reached and overcome.

Tetanus antitoxin is now produced commercially in several large laboratories, and in most cities it is on sale at the principal drug stores. A bar to its more frequent use is its comparatively high cost.

An amount just sufficient to confer immunity in the case of a suspected wound costs $1, and the amount needed to arrest an ordinary case costs from $25 to $40. When it becomes necessary to employ it in large quantities, as in very serious cases, the cost of the antitoxin alone may reach $100, or even more, and beside that, its use involves the employment of skilled and expensive surgical aid.

But fortunately in most large cities there are endowed hospitals that give the treatment without charge to all who need it.

A study of tetanus leads to the conclusion that it is almost always blameable on a reluctance to seek experienced medical aid. Most persons, when they are lacerated by a firecracker or a garden implement, bind up their wounds themselves, frequently without even ordinary washing. The folly of this is only too apparent. At best healing is preceded by suppuration, and the result is much pain and an unsightly scar. At worst, tetanus, develops and death is not far away.

Whenever one sustains a contused wound, it is advisable to wash it thoroughly and at once with soap and water, and to flood it, before binding it up, with common peroxide of hydrogen. The peroxide gives off oxygen, which causes the death of all tetanus germs it reaches. After this has been done, the wound should be covered, not with a handkerchief or an old rag, but with a strip of the antiseptic bandage sold at low cost by all drug stores.

A clean, open wound, which bleeds freely, is little apt to harbor the germs of lockjaw. The light and air striking into it kill them, and the flowing blood washes them out. In all such cases, unless the flow of blood is excessive, it is well to make no effort to stop it. It will cease of itself in a few moments. The use of such homely remedies as spider-webs to stop the flow, is foolhardy and frequently suicidal. The average spider-web, particularly if it comes from a cellar or a stable, is alive with germs.

Beyond all things it is well to have a doctor dress all wounds, no matter how small they may be. He alone is capable of washing them as they should be washed, and of estimating the likelihood of infection. His fee is money well invested. It may buy only insurance against a long, terrible, painful and expensive illness, and then again it may buy insurance against death.

The growing use of tetanus antitoxin is gradually stamping out lockjaw in the United States. The careful and excellent reports of the Journal of the American Medical association show that whereas there were 415 cases of lockjaw following Fourth of July accidents in 1903, the number dropped to 105 a year later, to 104 in 1905, to 80 in 1906 and to 73 in the present year. There is also a lowering mortality, showing that the antitoxin is being more and more used after the development of symptoms.

The reason why lockjaw is so often associated with Fourth of July accidents lies in the fact that wounds made by firecrackers, skyrockets and blank cartridges are commonly ragged and contused, and so afford a favorable soil for the germs.

(Copyright, 1907, by J. W. Muller.)